

## MAGNETIC-ADHESIVE MOUNTING DEVICE

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### Field of the Invention

10 The present invention relates to first structures each comprising a permanent magnets a magnet surface adapted to be positioned along a surface of a second structure comprising a layers of ferrous or ferromagnetic material so that one structures can be supported on the other structure by magnetic attraction, which first structure includes a layer of material that restricts relative movement between the first and second structures in the plane of their adjacent surfaces.

### Background of the Invention

15 Many structures are known that each comprise at least one permanent magnet having a magnet surface adapted to be positioned along surfaces of structures comprising layers of ferrous or ferromagnetic material so that one of the structures can be supported on the other structure by magnetic attraction. Examples of such structures including a permanent magnet that has a planar surface intended to be supported by a planar surface of  
20 a structure including a layer of ferrous or ferromagnetic material are signs (which may bear pictures, sayings, memorabilia, advertising, etc.), hooks, spring clips, containers, or organizers which may be supported along refrigerators, metal furniture or cabinets, metal encased instruments, or the like. One example of such a structure including the permanent magnet which is intended to support the structure including the layer of ferrous or  
25 ferromagnetic material is described in U.S. Patent No. 5,992,807 (Tarulli). In that structure a magnet permanently secured to the dashboard of a vehicle is adapted to removably retain a cell phone along a vertical surface of the magnet due to the magnetic attraction between the magnet and metal parts of the cell phone. Magnetic attraction between such structures provides instant attachment of the structures and good resistance  
30 to separation of the structures by pulling one from the other in a direction normal to their planar surfaces, however, it has limited ability to restrict slippage of the planar surfaces of the structures relative to each other. Thus when the planar surfaces of the structures are

generally vertical the weight of the supported structure will often cause it to slide along the planar surface of the supporting structure, particularly when the structures are exposed to vibration, shock, or centrifugal forces. U.S. Patent No. 5,992,807 describes providing “a thin layer of rubber or other suitable material “ over the surface of the magnet that

5 “provides a frictional resistance which is supplementary to the magnetic and prevents the cell phone from slipping down”, but provides no specifics concerning the type of rubber or other material to be used, or their effectiveness in preventing such slipping down.

#### Disclosure of the Invention

10 Like the prior art described above, the present invention provides a first structure comprising a permanent magnet having a magnet surface adapted to be positioned along a surface of a second structure comprising a layer of ferrous or ferromagnetic material so that one of the structures can be supported on the other structure by magnetic attraction. The present invention is significantly improved from those prior art structures, however, in

15 that the first structure further comprises a layer of removable pressure sensitive adhesive having a surface parallel with the magnet surface that is positioned to releasably adhere to the surface of the second structure and thereby significantly restrict slipping of the surfaces of the first and second structures relative to each other. While the adhesion of the layer of removable pressure sensitive adhesive to the planar surface will provide a high

20 force in shear to restrict such slipping, it does not significantly increase the force required to separate the structure from the second structure, which separation is typically caused by manually pulling and/or peeling the supported structure away. This combination of magnetic attraction provided by the magnet to retain engagement of the structures against pulling and/or peeling forces and adhesion of the layer of removable adhesive that retains

25 the relative positions of the structures against shear forces acting in the plane of the engaged surfaces allows the supporting structure to support a supported structure of significantly greater weight in a fixed position than could be supported if the layer of removable adhesive were not present, or if that layer or removable adhesive were replaced by a layer of non-adhesive material such as a layer of “rubber or similar material” as is

30 described in U.S. Patent No. 5,992,807.

The layer of removable pressure sensitive adhesive can extend over the planer magnet surface, or can be in a layer having a surface coplanar with the planer magnet

surface which, for example, could extend around that magnet surface or be positioned on a side of that planer magnet surface where it will be biased into engagement with the planar surface of the second structure by torsional forces caused in the first structure resulting from the weight of the supported structure.

5 By removable pressure sensitive adhesive we mean to include the micro-structured relatively low tack and low adhesion type of removable and repositionable pressure sensitive adhesive available from 3M company, St. Paul, MN under the trademark "Post-it" (e.g., the removable and repositionable adhesive layer on No. 9416 "Post-it" brand transfer tape commercially available from 3M Company, St. Paul, MN), and any other  
10 relatively low tack and low adhesion removable and repositionable pressure sensitive adhesive that will adhere to most surfaces, but can be peeled away without leaving a residue and can then again be adhered to a surface, particularly including such adhesives which are micro-structured.

By perminant magnet we mean to include the type of flexible or molded  
15 permanent magnets sold under the trademark "PLASTIFORM" by the Plastiform division of Arnold Magnetics, Norfolk, Nebraska), and other perminant magnets that may have other structures such as all metal structures.

#### Description of Drawing

The present invention will be further described with reference to the accompanying  
20 drawing wherein like reference numerals refer to like parts in the several views, and wherein:

Figure 1 is a perspective view of a first embodiment of a device according to the present invention shown attached to a vertical surface;

Figure 2 is a side view of the device of Figure 1;

25 Figure 3 is a perspective view of a second embodiment of a device according to the present invention;

Figure 4 is an enlarged sectional view taken approximately along line 4-4 of Figure  
3;

Figure 5 is a side view of a third embodiment of a device according to the present  
30 invention;

Figure 6 is a rear view of the device of Figure 5;

Figure 7 is a perspective view of a fourth embodiment of a device according to the present invention; and

Figure 8 is a perspective view of a fifth embodiment of a device according to the present invention.

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#### Detailed Description of the Invention

Referring now to Figures 1 and 2 of the drawing there is illustrated a first embodiment of a first structure or hook assembly according to the present invention generally designated by the reference numeral 10. The hook assembly 10 comprises a  
10 polymeric support member 12 having a rectangular planar rear surface 13 on which is adhered a rectangular permanent magnet 14 (e.g., a flexible or molded permanent magnet of the type sold under the trademark "PLASTIFORM" by the Plastiform division of Arnold Magnetics, Norfolk, Nebraska). The magnet 14 has a planar magnet surface 16 on its side opposite the support member 12 that is adapted to be positioned along a planar  
15 vertically disposed surface 18 of a second structure comprising a layer of ferrous or ferromagnetic material (e.g., a thin steel outer layer of a refrigerator wall or a steel cabinet wall that can have a painted outer surface) so that the hook assembly 10 will be supported along the surface 18 of the second structure by magnetic attraction. The first structure or hook assembly 10 further comprises a layer 20 of removable pressure sensitive adhesive  
20 (e.g., that layer 20 being provided by No. 9416 "Post-it" brand transfer tape commercially available from 3M Company, St. Paul, MN, which comprises a support layer between a layer of strong or permanent pressure sensitive adhesive adhered to the surface 16 and a layer of removable pressure sensitive adhesive that provides the layer 20) overlaying the planar magnet surface 16, which layer 20 of removable pressure sensitive adhesive has an  
25 exposed planar surface 21 parallel with that planar magnet surface 13 adapted to releasably adhere to the planar surface 18 of the second structure and thereby restrict slipping of the surface 21 of the hook assembly 10 and the surface 18 of the second structure relative to each other in a direction parallel to those surfaces 21 and 18. The support member 12 includes a hook-like structure 22 projecting along its side opposite the  
30 magnet 14 from which objects may be suspended, as by a cord received in a channel 24 defined by the hook-like structure 22.

A test was performed to determine the ability of a first structure or hook assembly 10 of the type described above to support weight along a vertically disposed surface of a second structure, compared to a similar hook assembly supported on that same vertically disposed surface only by a magnet (called a "magnet only" hook assembly herein), or only  
5 by a layer of removable pressure sensitive adhesive (called an "adhesive only" hook assembly herein). Three identical support members 12 of the type described above were used, each having a rectangular planer surface 13 that was 0.63 inch or 1.6 cm wide and 2 inches or 5.08 cm high. A flexible permanent magnet 14 of the type sold under the trademark "PLASTIFORM" by the Plastiform division of Arnold Magnetics, Norfolk,  
10 Nebraska, about 0.06 inch or 0.15 cm thick and having the same peripheral dimensions as the surface 13 was adhered on the surface 13 of a first one of the support members 12. Over the surface of that magnet opposite the surface 13 was adhered a layer 20 of removable pressure sensitive adhesive (i.e., that layer 20 being provided by No. 9416 "Post-it" brand transfer tape commercially available from 3M Company, St. Paul, MN,  
15 which included a support layer between a layer of strong or permanent pressure sensitive adhesive that was adhered to the magnet and the layer 20 of removable pressure sensitive adhesive), thereby forming a test hook assembly 10 having the structure described above. A magnet identical to the magnet 14 used in the test hook assembly 10 was adhered on the surface 13 of a second one of the support members 12 to form the "magnet only" hook  
20 assembly. A layer 20 of removable pressure sensitive adhesive formed of No. 9416 "Post-it" brand transfer tape and having the same peripheral dimensions as the surface 13 was adhered on the surface 13 of a third one of the support members 12 to form the "adhesive only" hook assembly. The three test hook assemblies were attached to the vertically disposed surface of a painted steel cabinet and increasing numbers of ½ pound weights  
25 were hung on the test hook assemblies until they began to slide down or separated from the vertically disposed surface. The "magnet only" hook assembly could only support one ½ pound weight and slid down the vertical surface when the second ½ pound weight was added. The "adhesive only" hook assembly could only support one ½ pound weight and separated from the vertical surface when the second ½ pound weight was added. The test  
30 hook assembly 10 having the structure described above supported four ½ pound weights or 2 pound before sliding, which was significantly more than the total amount of weight

supported by the other two test hook assemblies. The test hook assembly 10 was found to be easily manually removed from and repositioned on the vertically disposed surface.

Another test was done with a product called a "Nifty Products Magnetic Locker Box" which is commercially available from Carolina Pad Company, Charlotte, NC, and is a plastic rectangular container adapted to hold items that has a permanent magnet with a planar surface along a rear wall of the container by which the container can be magnetically attached to a vertical metal wall, such as the metal wall of a refrigerator, school locker, or office cabinet. The "Locker Box" was magnetically attached to the vertical painted metal wall of an office cabinet. A first ½ pound weight placed in the "Locker Box" did not cause it to move; however, when a second ½ pound weight was placed in the "Locker Box" it would slip along the wall and sometimes drop away from the wall. A strip of ¾ inch wide No. 9416 "Post-it" brand transfer tape commercially available from 3M Company, St. Paul, MN, was then adhered across the bottom portion of the planer surface of the magnet, and the "Locker Box" was magnetically and adhesively attached to the same vertical metal wall. The "locker Box" could then support eight ½ pound weights (i.e., a total of 4 pounds), and could still be easily manually removed from and repositioned along the vertical wall.

Both tests described above were preformed during the first adhesion of the layers of repositionable adhesive to the vertical wall or surface. It was found that each removal and repositioning of those layers of repositionable adhesive along vertical surfaces decreased their effectiveness to help slipping of the perminant magnets along those surfaces, presumably because of increased surface contamination of the layers of repositionable adhesive.

Referring now to Figures 3 and 4 of the drawing there is illustrated a second embodiment of a structure or hook assembly according to the present invention generally designated by the reference numeral 30. The hook assembly 30 comprises a polymeric support member 32 having essentially the same structure as the support member 12 described above, including a planer rectangular rear surface 33 on which is centrally adhered a rectangular permanent magnet 34 (e.g., a flexible or molded permanent magnet of the type sold under the trademark "PLASTIFORM" by the Plastiform division of Arnold Magnetics, Norfolk, Nebraska). The magnet 34 has a periphery spaced from the periphery of the rear surface 33 and has a planar magnet surface 36 on its side opposite the

support member 32 that is adapted to be positioned along a planar vertically disposed surface of a second structure comprising a layer of ferrous or ferromagnetic material (e.g., a thin steel outer layer of a refrigerator wall or a steel cabinet wall that can have a painted outer surface) so that the hook assembly 30 will be supported along the surface of the second structure by magnetic attraction. The first structure or hook assembly 30 further comprises a layer 40 of removable pressure sensitive adhesive (e.g., that layer 40 being provided by No. 9416 "Post-it" brand transfer tape commercially available from 3M Company, St. Paul, MN) on the rear surface 33 around the periphery of the magnet 34, which layer 40 of adhesive has a planar surface 41 parallel to and generally coplanar with the planar magnet surface 33. The planar surface 41 of the layer 40 of removable pressure sensitive adhesive is adapted to releasably adhere to the planar surface of the second structure and thereby restrict slipping of the surfaces 36 and 41 and the hook assembly 30 along the surface of the second structure. The support member 32 includes a hook-like structure 42 projecting along its side opposite the magnet 34 from which objects may be suspended, as by a cord received in a channel 44 defined by the structure 42.

Referring now to Figures 5 and 6 of the drawing there is illustrated a third embodiment of a structure or hook assembly according to the present invention generally designated by the reference numeral 50. The hook assembly 50 comprises a polymeric support member 52 having a planer rectangular rear surface 53. Over an upper portion of that rear surface 53 is adhered a rectangular permanent magnet 54 (e.g., a flexible or molded permanent magnet of the type sold under the trademark "PLASTIFORM" by the Plastiform division of Arnold Magnetics, Norfolk, Nebraska) having a planar magnet surface 56 on its side opposite the support member 52 that is adapted to be positioned along a planar vertically disposed surface of a second structure comprising a layer of ferrous or ferromagnetic material (e.g., a thin steel refrigerator or cabinet wall that can have a painted outer surface) so that the hook assembly 50 will be supported along the surface of the second structure by magnetic attraction. The bottom peripheral edge of the magnet 54 is spaced from the bottom edge of the rear surface 53 and the first structure or hook assembly 50 further comprises a layer 60 of removable pressure sensitive adhesive (e.g., that layer 20 being provided by No. 9416 "Post-it" brand transfer tape commercially available from 3M Company, St. Paul, MN) on the rear surface 53 between the adjacent bottom peripheral edges of the rear surface 53 and of the magnet 54. That layer 60 of

removable pressure sensitive adhesive has a planar surface 61 parallel and coplanar with that planar magnet surface 53 that is adapted to releasably adhere to the planar surface of the second structure and thereby restrict slipping of the surfaces 56 and 61 and the hook assembly 50 along the surface of the second structure. The support member 52 includes a hook-like structure 62 projecting along its side opposite the magnet 54 from which objects may be suspended, as by a cord received in a channel 64 defined by the structure 62. The weight of objects supported by the hook-like structure 62 will cause a torsional force in the support member 52 that will press the layer 60 of removable pressure sensitive adhesive into firm engagement the second structure on which it is attached.

Referring now to Figure 7 of the drawing there is illustrated a fourth embodiment of a structure according to the present invention generally designated by the reference numeral 70. The structure 70 comprises a rectangular permanent magnet 72 (e.g., a flexible or molded permanent magnet of the type sold under the trademark "PLASTIFORM" by the Plastiform division of Arnold Magnetics, Norfolk, Nebraska) having front and rear planar magnet surfaces 73 and 74, and a layer 75 of removable pressure sensitive adhesive over the rear magnet surface 74 (e.g., that layer 75 being provided by No. 9416 "Post-it" brand transfer tape commercially available from 3M Company, St. Paul, MN). A display object provided by a layer 76 of material (e.g., paper, polymeric sheet material, or paint) having graphics 77 along its outer surface opposite the magnet 72 is attached or adhered over the front magnet surface 73. A surface 78 of the layer 75 of removable pressure sensitive adhesive opposite the magnet 72 is adapted to be releasably adhered to and to be magnetically attached along a vertically disposed surface 79 of a second structure that comprises ferrous or ferromagnetic material. The structure 70 could, for example, be the size of a conventional refrigerator magnet, or could be very much larger and used to cover a metal substrate with graphics 77 that are decorative and/or provide political or advertising information. Instead of being the layer 76 of material having graphics 77 along its outer surface, the display object could, for example, be a light fixture, such as a temporary emergency light of the type sometimes used on police vehicles, or could be an instrument such as a thermometer, barometer, or the like, or could be any other object that a person wishes to display along a surface 79 of a second structure that comprises ferrous or ferromagnetic material.



Referring now to Figure 8 of the drawing there is illustrated a fifth embodiment of a structure according to the present invention generally designated by the reference numeral 90. The structure 90 comprises a rectangular permanent magnet 92 (e.g., a flexible or molded permanent magnet of the type sold under the trademark  
5 "PLASTIFORM" by the Plastiform division of Arnold Magnetics, Norfolk, Nebraska) having front and rear planar magnet surfaces 93 and 94, a layer 95 of removable pressure sensitive adhesive over the rear magnet surface 94, and a layer 96 of removable pressure sensitive adhesive over the front magnet surface 93 (e.g., those layers 95 and 96 being provided by No. 9416 "Post-it" brand transfer tape commercially available from 3M  
10 Company, St. Paul, MN) so that the layers 96 and 97 of removable pressure sensitive adhesive have planar surfaces 100 and 101 respectively which are parallel and coplanar with the planar magnet surfaces 94 and 93. The surface 100 is adapted to releasably adhere to and be magnetically attached along a vertically disposed surface 103 of a second structure that comprises ferrous or ferromagnetic material, whereas the surface 101 is  
15 adapted to releasably adhere to the surfaces of ferrous or ferromagnetic objects positioned along the surface 101 to thereby restrict slipping of those objects in the plane of the surface 101. Examples of such objects could include knives, scissors, wrenches, dental tools, sockets, etc., and instead of being planar, the surface 101 could be shaped to make more intimate contact with non planar objects, such as by having transverse semi-  
20 cylindrical and/or V-shaped grooves adapted to receive portions of cylindrical or rectangular objects.

The present invention has now been described with reference to several embodiments and modifications thereof. It will be apparent to those skilled in the art that many changes can be made in the embodiments described above without departing from  
25 the scope of the present invention. For example, the hook-like structure 22, 42, or 62 on the support member 12, 32, or 52 of the first structure 10, 30, or 50 described above could be replaced by other means for engaging a third structure or object such as a spring clip or clamp, a pin, a cup-like structure or container, or an organizer; and/or the support  
members 12, 32, or 52 could have graphics (i.e., pictures, sayings, memorabilia,  
30 advertising, etc.) on their surfaces opposite the magnet 14, 34, or 54. The hook-like structure 22, 42, or 62 on the support member 12, 32, or 52 of the first structure 10, 30, or 50 described above could be replaced by other objects that need support such as sensors

for instruments, novelty gadgets, shelves, electrical termination boxes, light fixtures, and radio antennas and other temporary articles mounted on automobiles, trucks and railroad cars. Release liners could be provided over the exposed surfaces of the layers of removable pressure sensitive adhesive on the structures described above to restrict contamination of those adhesive surfaces prior to use. Thus, the scope of the present invention should not be limited to the structures described in this application, but only by the structures described by the language of the claims and the equivalents thereof.